Science Virtual Learning

MPI Physics 240
Thermodynamics 7: Latent Heat
April 30, 2020

Lesson: MPI Thermodynamics 7 – Latent Heat
April 30, 2020

Objective: To understand heat flows during phase transitions, and why they happen at constant temperature

This video discusses heat flows during phase transitions, and why they happen at constant temperature.

https://youtu.be/SlnuVK4J3wM

Video: Latent Heat

TABLE 19.2 Latent Heats of Fusion and Vaporization

Substance	Melting Point (°C)	Latent Heat of Fusion (J/kg)	Boiling Point (°C)	Latent Heat of Vaporization (J/kg)
Helium[a]	−272.2	5.23×10^3	−268.93	2.09×10^4
Oxygen	−218.79	1.38×10^4	−182.97	2.13×10^5
Nitrogen	−209.97	2.55×10^4	−195.81	2.01×10^5
Ethyl alcohol	−114	1.04×10^5	78	8.54×10^5
Water	0.00	3.33×10^5	100.00	2.26×10^6
Sulfur	119	3.81×10^4	444.60	3.26×10^5
Lead	327.3	2.45×10^4	1 750	8.70×10^5
Aluminum	660	3.97×10^5	2 450	1.14×10^7
Silver	960.80	8.82×10^4	2 193	2.33×10^6
Gold	1 063.00	6.44×10^4	2 660	1.58×10^6
Copper	1 083	1.34×10^5	1 187	5.06×10^6

[a]Helium does not solidify at atmospheric pressure. The melting point given here corresponds to a pressure of 2.5 MPa.

Latent Heat Table

TABLE 19.1 Specific Heats of Some Substances at 25°C and Atmospheric Pressure

Substance	Specific Heat (J/kg · °C)	Substance	Specific Heat (J/kg · °C)
Elemental solids		*Other solids*	
Aluminum	900	Brass	380
Beryllium	1 830	Glass	837
Cadmium	230	Ice (−5°C)	2 090
Copper	387	Marble	860
Germanium	322	Wood	1 700
Gold	129		
Iron	448	*Liquids*	
Lead	128	Alcohol (ethyl)	2 400
Silicon	703	Mercury	140
Silver	234	Water (15°C)	4 186
		Gas	
		Steam (100°C)	2 010

Note: To convert values to units of cal/g · °C, divide by 4 186.

Specific Heat Table

Ex 1. How much energy does it take to completely boil off 2 liters (2.00 kg) of water that starts at 20.0°C? If the burner heating the water has a power of 1200 W, how much time does it take to boil off the water?
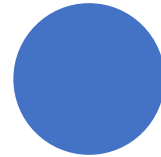
Ex 2. If you put 0.250 kg of water at 18.0°C in an ice tray and stick it in the freezer, how much heat must be removed from the water to turn it into ice at -15.0 °C?

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Part 1: https://youtu.be/qK0esR_Q3_4

Part 2: https://youtu.be/IWch_atPLnI

Latent Heat - Examples

Homework 1

- Try to solve the problem yourself, then watch the solution video:
- https://youtu.be/qP2Dt39kTyY

1. How much heat must be added to 0.500 kg of lead at 15.0°C to raise its temperature to the melting point (327 °C) and then melt it completely?

Homework 2

- Try to solve the problem yourself, then watch the solution video:
- https://youtu.be/4BxtTyMn3ho

2. A 0.100-kg ice chunk at its melting point (0°C) is added to 0.644 kg of water.

a) How much energy must the ice absorb to melt completely?

b) How much did the temperature of the water lower due to the ice melting?

That's it!